

fact, column 2, lines 40-46 of NISHITANI et al. disclose forming a  $\text{MoSi}_2$  film onto aluminum to increase the reproducibility of low contact resistance and increase the contact resistance of the tungsten/aluminum interface. There is no disclosure or suggestion that the  $\text{MoSi}_2$  film is a copper-diffusion stopper insulating film as recited in claim 1 of the present application.

In addition, column 8, lines 26-28 of NISHITANI et al. disclose an aluminum wiring sometimes containing a small amount of silicon, copper, etc. An aluminum wiring containing a small amount of copper does not read on one of a copper region, a copper based region and a copper alloy region as recited in claim 1 of the present application. Page 1, lines 15-17 of the present application disclose metal interconnections containing copper or copper alloys containing copper at not less than 80%. An aluminum wiring that sometimes contains a small amount of copper does not anticipate the recited feature. Accordingly, claim 1 is believed patentable over the cited prior art.

Claims 4, 6, 57 and 58 depend from claim 1 and further define the invention and are also believed patentable over the cited prior art.

In addition, claim 6 recites that the anti-corrosion treatment is carried out at the same time as a cleaning process for removing metal contaminations. Column 5, lines 64-67 of NISHITANI et al., noted in the Official Action, disclose that a treatment of removing residual chlorine is necessary as an anti-

corrosive treatment after the surface cleaning treatment, not at the same time as the cleaning treatment. Further, column 5, lines 1-12 of NISHITANI et al. disclose carrying out the following treatments successively: 3-(1) a surface cleaning treatment and then 3-(2) an anti-corrosive treatment. NISHITANI et al. do not disclose or suggest that the anti-corrosive treatment is carried out at the same time as the cleaning process for removing metal contaminations as recited in claim 6 of the present application.

Claim 57 of the present application recites flowing anti-corrosive agent onto the surface of the semiconductor substrate. In contrast, column 6, lines 1-25 of NISHITANI et al. disclose oxygen plasma treatment or fluorine plasma treatment by passing a gas mixture over the wafer surface.

Claim 58 recites forming an insulating film by chemical vapor deposition. Column 5, lines 13-15 of NISHITANI et al., noted in the Official Action, disclose depositing tungsten by chemical vapor deposition, not depositing an insulating film by chemical vapor deposition. Column 2, lines 45 and 46 of NISHITANI et al. disclose attaching a  $\text{MoSi}_2$  film onto aluminum to form an underlayer of an aluminum laminate film. Attaching a  $\text{MoSi}_2$  film (noted in the Official Action with regards to claim 1 as the insulating film) does not read on forming a copper-diffusion stopper insulating film by chemical vapor deposition as recited in claim 58 of the present application.

Claims 2-3, 5, 7, 16, 18-23, 32, 60 and 61 are rejected as being unpatentable over NISHITANI et al. in view of OBENG et al. 6,323,131. This rejection is respectfully traversed.

OBENG et al. do not disclose or suggest the steps of carrying out an anti-corrosion treatment by exposing a surface of a semiconductor substrate to a solution containing an anti-corrosive agent and subsequently, separately forming a copper-diffusion stopper insulating film over the surface of the semiconductor substrate as recited in claim 1 of the present application. As noted above, NISHITANI et al. do not disclose or suggest what is recited in claim 1. Since claims 2-3, 5, 7 and 16 depend from claim 1 and further define the invention, the combination of references would not render obvious claims 2-3, 5, 7, and 16.

Claim 18 also recites the steps of carrying out an anti-corrosion treatment by exposing a surface of a semiconductor substrate to a solution containing an anti-corrosive agent and subsequently, separately forming a copper-diffusion stopper insulating film over the surface of the semiconductor substrate. The comments above regarding claim 1 are equally applicable to claim 18.

MPEP §2143.01 states that the prior art must suggest a desirability of the claimed invention. "In determining the propriety of the Patent Office case for obviousness in the first instance, it is necessary to ascertain whether or not the

reference teachings would appear to be sufficient for one of ordinary skill in the relevant art having the reference before him to make the proposed substitution, combination, or other modification." *In re Linter*, 458 F2d 1013, 1016, 173 USPQ 560, 562 (CCPA 1972).

NISHITANI et al. teach an aluminum wiring 22 having an SiC<sub>2</sub> film 23 formed over the aluminum wiring 22 by plasma CVD and then forming a large number of small holes by photo etching. In contrast, OBENG et al. teach etching vias 16 to form a damascene structure and then filling the vias with copper. Accordingly, the wiring layer 22 of OBENG et al. is entrenched in the dielectric layer 10, whereas the SiC<sub>2</sub> film 23 is formed over the aluminum wiring 22 of NISHITANI et al. Therefore, the two references teach opposite methods of forming an interconnection.

One of ordinary skill in the art would not be motivated to combine the two references in the first instance and in any event would not be motivated to combine the two references to perform a chemical mechanical polishing process for forming an interconnection in a groove of a semiconductor substrate as recited in claim 18 of the present application. There is no teaching in either of the references that a dual damascene method can be substituted for a method of forming a wiring covered by a dielectric or vice versa. Accordingly, the teachings of the references are insufficient for one of ordinary skill in the art

to make the proposed combination and thus a case for obviousness in the first instance has not been established.

Claims 19-23, 32 and 60-61 depend from claim 18 and further define the invention. For the reasons set forth above regarding claim 18, claims 19-23, 32 and 60-61 are believed patentable over the cited prior art.

In addition, the comments above regarding claim 6 are equally applicable to claim 22.

Claims 17 and 59 are rejected as unpatentable over NISHITANI et al. This rejection is respectfully traversed.

Claims 17 and 59 depend from claim 1 and further define the invention. For the reasons set forth above regarding claim 1, claims 17 and 59 are also believed patentable over the cited prior art.

In addition, claim 17 recites that the copper-diffusion stopper insulating film comprises an SiON film and claim 59 recites that the copper-diffusion stopper insulating film comprises one of  $Si_3N_4$  film and SiON film. The Official Action's position is that it would be obvious to substitute  $MoSi_2$  because  $MoSi_2$  is well-known in the industry. Page 48, lines 3-6 of the present application, for example, disclose forming an  $Si_3N_4$  film at 400°C. A silicide layer like  $MoSi_2$  is formed at a temperature of about 1100°C. One of ordinary skill in the art would not be motivated to substitute these materials for each other based on.

the large temperature difference used when forming the two materials.

Claims 33 and 62 are rejected as being unpatentable over NISHITANI et al. in view of OBENG et al. This rejection is respectfully traversed.

The comments above regarding claims 17 and 59 are equally applicable to claims 33 and 62.

Claims 8-15 and 24-31 are rejected as being unpatentable over NISHITANI et al. in view of OBENG et al. and further in view of LAWSON 4,978,756. This rejection is respectfully traversed.

LAWSON is cited for the teaching of specific compounds used for treatment of metal. LAWSON does not teach or suggest carrying out an anti-corrosion treatment by exposing a surface of a semiconductor substrate to a solution containing an anti-corrosive agent and subsequently, separately forming a copper-diffusion stopper insulating film over the surface of the semiconductor substrate as recited in claims 1 and 18 of the present application. As noted above, neither NISHITANI et al. nor OBENG et al. teach or suggest what is recited in claims 1 and 18. Since claims 8-15 and 24-31 depend from claims 1 and 18, respectively, the combination of references would not render obvious claims 8-15 and 24-31.